Remarks

Interview

Applicant thanks the Examiner for the favor of a brief telephone interview, conducted on July 28, 2004, between Examiner John Maples and representative Elizabeth Nugent. At the interview, Applicant and Examiner discussed differences between claim 1 and Fukuda I and II, as more fully set forth below. The Applicant further agreed that if the present Response is not deemed to place the application in condition for allowance, that a Request for Continued Examination will be filed. The Examiner indicated that he would grant a full telephone interview before issuing a first action, if such a Request is filed.

The claimed invention

The present invention comprises fuel cells and methods of generating electrical power using a fuel cell. The fuel cells of the invention use a borohydride anolyte, one cathode catalyst, and two anode catalysts. The first anode catalyst catalyzes the anolyte to generate hydrogen, while the second anode catalyst catalyzes the hydrogen to produce hydrogen ions.

The prior art

Fukuda I and Fukuda II describe a fuel cell that uses hydrazine or sodium borohydride for fuel. They use a single anode catalyst, comprising an alloy of nickel and platinum, or a platinum coating deposited on a nickel base.

Amendola describes a borohydride compound mixed with a nonaqueous carrier and used for powering a fuel cell. No co-catalyst system is described.

Rejections under 35 U.S.C. § 102

Claims 1-10, 12-25, and 27-30 stand rejected under 35 U.S.C. § 102(b) as anticipated by either Fukuda I or Fukuda II. Applicant respectfully traverses this rejection for the reasons set forth below.

As previously amended, independent claims 1 and 16 (from which claims 2-10, 12-15, 17-25, and 27-30 depend) both clarify that the two anode catalysts of the fuel cell are separate – that is, physically deposited adjacent to one another, rather than one being a coating on the other.

(The term "separate" is not intended to exclude the possibility that the co-catalysts may be in contact with one another, but only to indicate that they are not in intimate contact at *all* surfaces). Thus, the fuel cell of the invention is structurally different from that of Fukuda.

The Office Action states that in Fukuda I and Fukuda II, the dual anode catalyst is either "1) a mixture of the two anode catalysts, or 2) where one of the anode catalysts is layered over the other anode catalyst." Neither of these configurations meets the limitations of the pending claims.

In case 1, where the anode comprises an alloy of a carrier metal and palladium, the anode cannot be described as comprising first and second anode catalysts, each separately embedded in the anode. Fukuda I and II describe mixing solutions of salts of nickel, antimony or copper, and palladium, and producing anodes by electrochemical plating from this mixed solution. Such plating will clearly produce an *essentially homogeneous alloy metal*, rather than a *mixture of separate catalysts* as described in the instant application (see, e.g., the separate ruthenium and platinum particles 18 and 19 of FIG. 1, and the accompanying description at paragraph 26). This mixture of separate anode catalysts is clearly recited in independent claims 1 and 16, each of which recite first and second *separately* embedded anode catalysts.

In case 2, where the anode comprises a layer of a base metal and a coating of palladium, the anode again cannot be described as comprising first and second anode catalysts, each separately embedded in the anode. In this case, the palladium coating is not "embedded" in the anode, since it consists of a top layer over a nickel-alloy base. Further, the nickel alloy does not act to "catalyz[e] the anolyte to generate hydrogen," as recited by independent claims 1 and 16, since it is not in contact with the anolyte, but merely serves as a substrate for the active palladium layer. The primary purpose of this substrate is to allow complete deposition of the palladium catalyst layer (see Fukuda I, col. 4, lines 9-19; Fukuda II, col. 4, lines 1-9 and 37-39), not to act itself as a catalyst. Thus, there is no need for the nickel-alloy substrate to be exposed to the anolyte, and in fact this substrate is disclosed to be coated with palladium (col. 4, lines 45-46). Since the first and second anode catalysts are not both exposed to the anolyte in this embodiment of Fukuda, they cannot accomplish the two-stage catalysis described in the instant application and recited in independent claims 1 and 16.

Further, one of ordinary skill in the art would not be motivated to alter either embodiment of the fuel cell of Fukuda by separating the co-catalyst materials, since the stated purpose of the platinum of Fukuda is to shield the nickel from the anolyte. (*See, e.g.*, Fukuda I, col. 2, lines 10-72; Fukuda II, col. 2, lines 7-60 and col. 3, lines 21-26). Thus, according to the teachings of Fukuda, it would be counterproductive to expose the nickel to the anolyte directly.

For at least the above reasons, claims 1-10, 12-15, and 27-30 are not anticipated by Fukuda I or Fukuda II. Reconsideration and withdrawal of the rejection is therefore respectfully requested.

Rejections under 35 U.S.C. § 103

Claims 11 and 26 stand rejected under 35 U.S.C. § 103(a) as obvious over Fukuda I or Fukuda II in view of Amendola.

As discussed above, Fukuda does not disclose the separate co-catalyst system recited in claims 1 and 16, from which claims 11 and 26 depend, respectively. This defect is not remedied by Amendola, which is relied upon solely to teach a nonaqueous carrier for a borohydride fuel. Thus, the combination of references cannot render claims 11 and 26 obvious. Reconsideration and withdrawal of the rejection is therefore respectfully requested.

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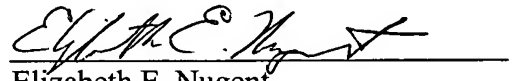
Respectfully submitted,



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